ERIC Document Resume	See Instruction Sheet	DATE OF RESUME	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.
ED002136	NA	1735

DO NOT WRITE IN SPACE BELOW

4. AUTHOR(S):
NA

5. TITLE OF DOCUMENT ABSTRACTED:
Automation
Its Meaning for Educational Administration

6. PUBLICATION TITLE:
NA

7. EDITOR(S):
NA

8. PLACE OF ORIGIN
ORG. Bureau of Publications, Teachers College
ST; CITY, STATE Columbia, New York

9. PUBLISHER OR SOURCE
Bureau of Publications, Teachers College, Columbia University, New York

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
NA	NA	1957	63

TELE. EXT.
INST/LOC CODE

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TYPE OF REPORT
PROPOSAL ☐
IN-PROGRESS ☐
FINAL ☒
FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR
Report

16. INDEXING TERMS (6-12)

automation	instructional technology			
administration	data processing			
administrators				

17. ABSTRACT (MAX. 250 WORDS)

A report of the Tenth Annual Meeting of the National Conference of Professors of Educational Administration (NCPEA), which was held to discuss automation and its implications for the preparation of school administrators, is presented.

The conference was undertaken because the NCPEA believed that automation is symbolic of vast changes at work in American life, education has a responsibility for understanding and reckoning with these changes, and automation has important implications for educational leadership and a deep significance for the professional preparation of administrators.

Three specialists presented papers at the conference. Automation was defined by R.W.Bolz, the implications of automation for public administration was explained by Herman Limberg, and the implications of automation for schools was presented by John H. Fischer.

After consideration of the papers, a panel of NCPEA members discussed the question, "What does automation mean for educational administration and for the professional preparation of administrators?" Comments were made on current organization and administrative patterns and on programs for preparing school administrators.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

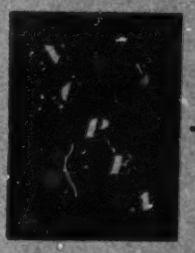
2

ERIC Form 1

1735

ED002136

INSTRUCTIONAL TECHNOLOGY - U.S.C. W 13



AUTOMATION

Its Meaning for

Educational Administration

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1935

AUTOMATION

Its Meaning for Educational Administration

A REPORT OF THE
NATIONAL CONFERENCE OF PROFESSORS OF EDUCATIONAL ADMINISTRATION

TENTH ANNUAL MEETING, UNIVERSITY OF ARKANSAS, FAYETTEVILLE
AUGUST 26–31, 1956

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Bureau of Publications
TEACHERS COLLEGE • COLUMBIA UNIVERSITY
NEW YORK • 1957

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LIBRARY OF CONGRESS CATALOG CARD NO. 57–12717

MANUFACTURED IN THE UNITED STATES OF AMERICA

STATEMENT

FROM THE NCPEA PLANNING COMMITTEE

THIS REPORT breaks new ground on a most important topic. The National Conference of Professors of Educational Administration is proud to present AUTOMATION: ITS MEANING FOR EDUCATIONAL ADMINISTRATION to teachers and school administrators, to college and university professors, and to all who may be interested in the implications automation holds for education. Its several sections urge us to constructive thinking about our country's future and the role of education in developing that future.

We are well into the age of atomic energy and automation. If we can harness these two great forces for the good of humanity, rather than for its destruction, a fabulous rise in the standard of living for all peoples of the world seems assured. With less time and human energy needed to produce the essentials, and even the luxuries, of good living, the responsibilities and the goals of education will change. The new day may see much greater emphasis on the cultural, citizenship, and avocational education for all—children and adults. Education for earning a living will be increasingly supplemented by the slower and more difficult education for service to mankind.

The National Conference of Professors of Educational Administration wishes to express its appreciation to the W. K. Kellogg Foundation for the financial aid which made possible the discussion of automation at the 1956 meeting held at the University of Arkansas in Fayetteville. Through a Kellogg grant, three consultants were invited to prepare papers on automation and they also served as moderators at the meeting. We are grateful to R. W. Bolz, editor of *Automation;* Herman Limberg, senior management consultant, New York City Administration; and John H. Fischer, superinten-

dent of public instruction, Baltimore, Maryland, for their many contributions to the discussions at Fayetteville.

Several members of NCPEA assisted in planning and arranging the conference sessions on automation and in editing this report. They were Walter A. Anderson, New York University; Forbes Bottomly and Walter D. Cocking of *The School Executive;* Daniel R. Davies, Teachers College, Columbia University; Richard C. Lonsdale, Syracuse University; Maurice F. Seay, W. K. Kellogg Foundation; and Wayne O. Reed, United States Office of Education.

Special recognition and appreciation go to Walter D. Cocking, consultant to NCPEA during its first ten years, for suggesting the topic, helping to make plans for the discussions, securing the services of consultants, chairing the *This We Believe* session at the meeting, and in editing this pamphlet. We commend it to you for thoughtful study.

THE NCPEA PLANNING COMMITTEE
WALTER A. ANDERSON, *1956 Chairman*

INTRODUCTION

THE NATIONAL CONFERENCE of Professors of Educational Administration devoted major attention at its Tenth Annual Meeting to the issue of automation and its implications for the preparation of school administrators. This pamphlet presents the subject matter of that meeting, a résumé of the discussions, and, finally, the agreements reached.

The NCPEA undertook this study of automation because it believed that:

1. Automation is symbolic of vast changes at work in American life.
2. Education by its very nature has a responsibility for understanding and reckoning with these changes.
3. Automation has important implications for educational leadership and a deep significance for the professional preparation of administrators.

The program was planned to permit the maximum use of time for discussion. To enable conferees to come informed to the meeting, the papers prepared by the three specialists on their respective topics were distributed to NCPEA members a month before the meeting date. The first paper, defining automation, was written by R. W. Bolz, editor of *Automation*, a magazine devoted to the new technology. The second paper, explaining the implications of automation for public administration, was prepared by Herman Limberg, senior management consultant with the New York City Administration. John H. Fischer, superintendent of public instruction, Baltimore, Maryland, authored the third paper on the implications of automation for education.

At the meeting the three papers were thoroughly analyzed, and the specialists were on hand to answer questions and interpret meanings. Attention was then directed by way of a panel discussion

to the meaning of automation for educational administration and for the professional preparation of administrators.

After the panel discussion, the members met in small groups to study in greater detail the social significance of automation, with special reference to educational administration. Out of these small groups came a number of agreements about the educational implications of automation. These agreements were drawn together into statements which were adopted by the NCPEA as its present beliefs about the significance of automation to education.

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1

AUTOMATION—AN AMERICAN EPOCH

R. W. BOLZ

Editor, AUTOMATION, *Cleveland, Ohio*

Every epoch has its character determined by the way its populations react to the material events which they encounter. . . . They may rise to the greatness of an opportunity, seizing its drama, perfecting its art, exploiting its adventure, mastering intellectually and physically the network of relations that constitutes the very being of the epoch. On the other hand, they may collapse before the perplexities confronting them. How they act depends partly on their courage, partly on their intellectual grasp.

—ALFRED NORTH WHITEHEAD

IN THE PAST FEW YEARS almost everyone at one time or another has heard or read of automation. All too little of what has been heard or read presented the real facts of the case—strangely enough, because automation is without question a development of American origin.

Today, everyone has a legitimate interest in automation. The word—in its broad significance to industry and business—has attained real and economic importance. Few industries today are totally unaffected by automation or can afford to ignore its possibilities.

A few years back, it was commonplace to accord the word *automation* fantastic science-fiction attributes. Having survived the onslaught of fiction writers, the real character of automation, which

has been emerging rapidly in recent years, is almost prosaic in comparison—actually, to some it is disappointing. Nevertheless, its accomplishments, applications, and possibilities are truly breathtaking.

WHAT IS IT?

Automation implies continuous or cyclic arrangement for manufacturing, processing, or performing services as automatically as economic conditions permit or dictate. Its accomplishment rests upon several important developments: principles of mass production, mechanization, and power and control equipment.

Mass production in the past was attained largely by hand methods, often by making the workman a virtual machine. Mechanization, or doing things by or with machines, for the most part merely made the workman an integral part of a mechanical cycle which was seldom automatic.

The technique of mass production permits manufacture of products at diverse locations to specified tolerances so that all are sufficiently identical to permit random use or random assembly in other products. Mass production and mechanization techniques constituted a major step in creating the possibility of providing large quantities of complex products with superior quality and uniformity at a lower cost in time and money. But today, manual methods often fail to fulfill the requirements because of economics, market demand, speed, labor, and other factors. The solution is the succeeding step in the manufacturing picture—automation.

EVOLUTION OF AUTOMATION

In the evolution of production techniques from their earliest form there have been several major steps. All these steps or forms are still on the industrial scene today. Early work toward meeting production demands and product quality was in the mechanization of heavy labor duties—the transfer of backbreaking efforts to mechanical devices and ultimately to machines.

The next major step was the automatic operation of a machine. Here, several closely related operations were arranged to take place automatically, in sequence, in a single machine.

Finally, in the next step, a number of machines, arranged for

automatic operation, were linked together with automatic devices for feeding the material or product and controlling its condition as it passed from machine to machine, from step to step, or from process to process. In the chemical, petroleum, and food industries, machines as well as various types of processing devices are involved. From the standpoint of the actual plant operations, the evolution has developed through such phases as hand production or craftwork, the well-known job shop, the department-oriented production shop, the progressive or straight-line hand operation, the conveyorized processing line, and the continuous automatic processing line or automation.

Automation largely aims to take separate processing operations and tie them together in an automatic continuous system. It can involve a few separate operations or all operations from raw materials to finished product. For example, instead of making pipe by a series of separate steps, steel billets are fed into the rolling mill and rolled into sheet; the sheet is formed, butt welded, cut to length and threaded, and emerges as finished pipe ready for use. By eliminating separate handling operations, more than seventeen miles of pipe can be produced in an hour.

TYPES OF AUTOMATION SYSTEMS

In the achievement of automation, groups or sequences of operations, automatic mechanisms or machines, and control devices are brought into a single system to produce continuous or cyclic operation. Wherever two or more automatic machines are tied together with overriding automatic controls to create a self-feeding, self-initiating, and self-checking progressive production process, an automated system is created. Material, data, or pieces can be introduced into such a system manually or automatically, and the processing steps are carried to completion without manual intervention. Generally, almost any process can be automated to some degree. It is possible to automate a single operation, a sequence of operations, a whole department, or an entire plant.

Automation can be classified into several types. It is possible to create an automatic batch system or an automatic continuous system. One process, for instance, may be carried out more economically in batches while another is more economical when produced

continuously. Process characteristics as well as economics dictate the best method. Likewise, limited-quantity and continuously varying operations may require batch-type arrangement, while mass-production operations are more economically carried out on a continuous basis.

Automation systems may be set up with end control or in-process control. With end control, processing is completed before testing, checking, or gauging is done. This is suitable with many processes and apparently feasible with others. However, where precision output is necessary, in-process control is desirable for economic reasons. Material being processed is under continuous control—metal parts, for instance, are gauged in the machine and correction or size-control is accomplished during the operation—and production of scrap is prevented. Chemical and other processing operations are held under continuous sensing and measuring instrument control, and necessary corrections are fed back to the equipment continuously.

AUTOMATION TODAY

There are many examples of automation on hand today. As we run through everyday necessities such as toothpicks, matches, paper, flour, breakfast cereals, beverages, food products, chemicals, hardware, and on down the list, the story is impressive. But today the accomplishments in these areas are being transplanted into other production fields. Automation *to some degree* can be found almost everywhere, from producing shovel handles to warehousing products. And the results are always similar—better products and distribution at lower unit costs.

Automation is not a thing of the future. It is here and is rapidly increasing in scope. For verification of this statement we can "take a look at the record."

There are consumer product plants turning out appliances at rates as high as one every thirty seconds, using hundreds of machines and miles of conveyors.

One paper mill, for instance, produces five hundred miles of facial tissue daily, sixty-eight inches wide, on a continuous automatically controlled line.

Continuous automatic production, in several steps from raw

materials to finished part, permitted the lamp bulb industry to produce an estimated two and a quarter billion lamps in 1955.

Use of full automation will see the success of the Taconite process for recovering high-purity iron from low-grade ores in our relatively depleted reserves. Completely automatic operations—with a per-ton expenditure of electric power 1650 per cent greater than in open-pit mining—will result in a process that can compete with foreign high-grade ores.

Telephone drop wire is produced on a round-the-clock basis to the tune of one and three-quarter billion feet a year. Copper is electroformed around steel base wire continuously, the wire is cleaned, lead and brass plated, inspected, and wound on reels at a rate in excess of three thousand feet per minute. Reels then go to the extrusion line where the insulating cover is applied in a continuous mechanical operation.

Through the use of punched tape, paperwork in widespread plant systems is closely coordinated. Sales data, office data, and shop orders come from the same master tapes, eliminating error and loss of time. Orders can be placed and delivery dates set within a matter of hours compared to the weeks or months previously required.

Coded tape, as used to reproduce information in complete form, can also be used to control other kinds of equipment. Today, machine tools are in use which follow instructions punched into a tape or recorded by similar coding marks on a photographic film or magnetic tape.

For airplane wing structures a machine "reads" a tape to drill holes, select rivets from automatic feeders, place and drive the rivets under precisely controlled conditions.

In warehousing, packages are carried into storage, delivered into specific areas, passed from floor to floor, drawn out, and fed to delivery stations—all under control of switches, relays, electric eyes, and other control devices. Work is progressing in automating sorting and picking operations, normally a tedious and costly process which sets a drastic limit on speed and cost in distribution of products.

In at least one plant today the processing of bacon is a continuous in-line operation "from the pig to the package."

THE STIMULATION TO AUTOMATION

It is essential to understand the main reasons that can create the need to automate, regardless of the scale of operations or their general character. By and large, it is a result of either the basic need to meet a mass market demand or to make possible a product that can be merchandised at an acceptable price, regardless of quantity.

As cost of raw materials rises along with wages only one end result can create an increased living standard. Commodity prices must hold the line or rise at a lesser rate than wages to create the necessary differential. To make this possible, production costs must be cut. All production operations which do not help directly in creating the product must be eliminated or minimized—such operations include handling, inspecting, warehousing, and so on.

In seeking to create higher quality products for lowest possible unit costs, automation offers most dramatic returns. The important achievement lies in the increased production gained with less scrap losses and less lost time, better and more uniform products, improved machine use, and more economic use of materials.

While it is impossible to do everything automatically, there are quite a few areas where it is not only possible but desirable. Machines eliminated slave labor and today automatic machines eliminate monotonous and unnecessary labor. As living standards rise and population grows, the mass market demand creates a growing pressure for goods. Under a free competitive system, this trend will eventually include automation.

An interesting development concerns bakeries. Conventional mass bread baking involves considerable wastage in stale loaves. Just recently equipment has been developed to make bread production completely automatic to the point of reaching the customer always fresh. Loaves are produced, baked in continuous ovens, packaged, quick-frozen, and passed into storage without stopping. Savings can forestall a rise in price and provide uniform working hours along with a continuous supply.

INVESTMENT IN AUTOMATION

In order to achieve these phenomenal results a great change has taken place in cost of the tools of production. In the oil industry,

for instance, a typical plant invests some $77,000 in tools for each worker—about 340 per cent more than at the turn of the century. And instead of a sixty-hour week there is the forty-hour week, with hourly pay equal to the former daily pay.

In the chemical industry the average investment per worker in 1954 amounted to $26,665, but for highly automatic plants it ranged as high as $42,500. Similarly, for all manufacturing, the investment was $12,933 with equally increased amounts for highly automatic plants.

Along with such investment in tooling is radically increased electric power to aid man's efforts. In average manufacturing operations, a typical 1944 plant used about four and one-half horsepower of driven machinery per man. By 1953 this had risen to nine and one-half horsepower. But for automated operations the power increase was much more rapid. Today, automated plants are being developed that use up to one hundred horsepower per worker, and individual cases exist where one man controls as much as one thousand horsepower or more of machinery.

AUTOMATION AND JOBS

There has been a great deal of concern over the effects of automation on jobs. This concern is largely unwarranted. To judge how slowly productivity moves up, for all the fanfare, it is revealing to see the figures on how steam and electric power tools displaced labor. A study by the Twentieth Century Fund shows that the percentage of work done by tool energy increased from 25 per cent in 1850 to 96 per cent in 1954.

These figures, in retrospect, offer proof that by 1954, when 96 per cent of the work was done by tools, almost *nobody* should have had jobs. Astonishingly enough, the progress in tools has actually helped employment as well as our standard of living.

Looking at the facts, the simple truth about machinery is that it works for all the people. It displaces some people, of course. Witness the blacksmith, the glass blower, the tinker—but it opens new jobs in operating the equipment, servicing it, helping design and build it, and selling its product, as well as in completely new industries. Outmoded occupations decline; recruitment swings to new fields.

The effect of automation is well described in the following quotation from the August 1955 *Supervisory News Letter* published by E. I. du Pont de Nemours & Co.

> Modern jobs are obviously less of a physical burden than were those of even a few years back, but today frequent efforts are made to picture the modern industrial employee as a mere robot. Foes of automation, for example, contend it will rob workmen of their personality, and make their actions as automatic as the machines they operate.
>
> Du Pont experience is directly contrary. . . . As brains replace brawn, a higher degree of judgment, selectivity, and knowledge is required than ever before. The dignity of the employee is enhanced by his greater knowledge, for even in mechanization there is no substitute for intelligence.

Automation has advantages. Since 1930, production of machinery has increased about fourfold. So has our gross national production. Working hours have decreased, but twice the number of people are working in industry, at triple the average pay of 1930, while relatively prices of goods (in ratio to wages) have held fairly steady. In addition, laboring jobs have declined steadily while skilled and semiskilled jobs have increased sharply.

Automatic factories will not be workerless factories. The actual total number of employees will increase in many cases, as has happened in the automotive, telephone, and other industries. Employment in all manufacturing industries alone has increased 71 per cent since 1939 while the population has increased about 26 per cent and the total labor force about 20 per cent. But unemployment in 1955 compared to 1939 declined 66 per cent. These figures are significant since it is in manufacturing that major progress in automation has been made.

Yes, automation will create jobs requiring more skill, more judgment, more responsibility, and less drudgery. It will give more people an opportunity to do creative work, to have better education and training, higher incomes, greater job opportunity and selectivity, more leisure and recreation.

THE PROBLEM OF EDUCATION

Another important aspect concerns the rising level of education today. Professors G. B. Baldwin and G. P. Schultz of Massachusetts Institute of Technology stated this fact clearly in a recent paper.

We are entitled to a cautious hope that automation may afford a partial answer to those who look at the rising education levels in this country and ask, "What are people going to do with all that education when they find themselves on the dull and routine jobs of American industry?" Mechanization may indeed have created many dull and routine jobs—but automation is not an extension but a reversal of this trend: it promises to cut out just that kind of job and to create others of higher skill.[1]

That automation provides an answer is verified by statistics from the chemical industry. Between 1947 and 1954 chemical output rose by more than 50 per cent; production workers increased only 1.3 per cent but nonproduction workers—professional, supervisory, clerical, and sales personnel—rose by more than 50 per cent. In the inorganic chemical industry this increase reached 70 per cent and in organic chemicals 100 per cent. In addition, on the production worker side, some plants employ as many as one skilled maintenance worker for every two production men. The trend in the mechanical and other industries toward becoming more automatic is in the same direction.

THE MARKET DEMAND

Perhaps the question has come to mind—will we end up with too great a production capacity? Present trends in population provide a key to the answer.

Dr. Gordon W. McKinley, chief economist of The Prudential Insurance Co. of America, points out that by 1965 the population will reach some one hundred and ninety million persons, an increase of thirty million over today's level. He predicts that gross national production will reach $540,000,000,000 compared with the $356,000,000,000 level of 1954.[2] To fulfill this more than 50 per cent increase in demand, only an 18 per cent increase in labor force will be available—persons under eighteen years of age together with those sixty-five and over will account for roughly 44 per cent of the population.

With the population growing rapidly at both ends and slowly

[1] Quoted from "Automation—A New Dimension to Old Problems," a paper presented at the December 28, 1954 meeting of the Industrial Relations Research Association in Detroit.

[2] From a luncheon address at the Finance Conference of the American Management Association, November 3–5, 1954, New York.

in the middle, demand for goods will increase much faster than the ability to produce unless productivity rises. Clerical help, for instance, cost some $25,000,000,000 in 1954 and is still rising. In 1940 there were five million clerks. Today there are eight million, but results are still inadequate. Automatic data handling has an answer.

THE LONG-RANGE IMPACT

In evaluating automation applications to all varieties of enterprise, one important statement has been mentioned occasionally by experienced automation specialists—"You can't 'lay off' an automatic line when business is slack." Once the decision has been made and the line installed, business management faces the relentless demand of economics to keep the line in operation. The alternative may be unpleasant—there is no easy out.

Automation creates the necessity for producing at a relatively continuous pace without big ups and downs. It demands improved knowledge of marketing and distribution methods, better product design, increased long-range planning, and full coordination of production, engineering, and sales activities; and it provides the strongest of incentives to make profitable output a reality.

The net result of increasing automation thus leads in the direction of leveling out the production and economic cycles. Needs and desires of a growing population never decrease—they will always be present in an upward trend. Automation offers a practical opportunity to meet these requirements, and at the same time it can contribute mightily toward increased stabilization of business economics. Properly implemented, automation can help continue the steady rise in our living standards.

2

AUTOMATION—IMPLICATIONS FOR PUBLIC ADMINISTRATION IN AMERICA*

HERMAN LIMBERG

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Office of the Mayor, The City of New York

IN THE MIDST of the general confusion and excitement which have been whipped up by automation, it is comforting to observe that no one has as yet come forward with a plan, prediction, or slogan for "push-button government." Such restraint, in the wake of the drive toward "push-button" factories and offices, does not signify a lag in technological progress; it represents the stabilizing force which will absorb the shocks and optimize the benefits which automation promises.

Although the new technology has made significant inroads into public administration, the developments and potential have received comparatively little attention because the primary impact of automation has been centered on private industry. The public clamor and fanfare which have proclaimed the eruption of the "second industrial revolution" have not yet enveloped the operations of government. Several levels and branches of government have evinced their interest in the industrial and commercial implications of automation, but the implications of automation for public administration have yet to receive intense consideration.

Despite the limited concentration on public administration, the patterns of government's approach to an appraisal of the ramifi-

* In this paper the author expresses his personal views: he is not speaking as an official representative of the City of New York.

cations of automation have been developing under the pressures inherent in democracy and progress. These pressures emanate from outside and from within governmental enterprise. External pressures seek prevention or solution of economic and social problems created by industrial and commercial applications of automation. Internal pressures stem from problems involved in applying automation to the administration and operations of governmental agencies.

Projection of the subject matter of this paper will thus follow this basic division of the total pattern of approach into two major classifications—external implications and internal implications. The various aspects of the subject will be considered in their relationship to each of these classifications.

Because automation is still very much of a nebulous term which has defied standardization of its definition, consideration of its implications should be predicated upon the meanings generally attributed to it. To provide a frame of reference within which the subject may be viewed in its proper focus, there is appended to this paper a digest of the definitions and concepts of automation which are currently circulating. Basically, there are three types of automation: (1) "Detroit automation" or "continuous automatic production," in which automatic machines are combined with transfer or handling equipment; (2) "feed-back automation," which consists of a self-correcting control system; and (3) integrated data processing, in which extensive mathematical computations are directed by programs on tapes or punched cards. In actual applications, any one type, or combinations of two or all three types, may be used.

Although the many definitions and concepts of automation might well be enhanced and simplified through standardization, they do serve to point up the implications for public administration. Even if they do not reflect "stabilized thinking," they impart special meaning to Thorstein Veblen's observation of forty years ago that "invention is the mother of necessity." The invention of automation has mothered the necessity to explore both its immediate and long-range effects and to plan and prepare to meet and deal with them effectively.

External Implications

Governmental interest in the social and economic problems raised by automation, and in the means to anticipate and solve them, has already been manifested in a number of recent instances.

During the fall of 1955, a Congressional inquiry into the impact of automation was made by a Subcommittee on Economic Stabilization of the Joint Committee on the Economic Report. At a press conference in March 1955, President Eisenhower stated that he expected the proper agencies of government to continue earnestly their investigations of automation and its developments, and that if it appeared necessary he might appoint a special commission to study the subject. The Bureau of Labor Statistics of the United States Department of Labor has been conducting a series of case studies of industrial and commercial applications of automation covering various labor aspects. This department's Bureau of Apprenticeship is now seeking to expand the number of joint labor–management programs to assure an adequate supply of skilled workers to meet the needs of automation. In May 1954, the New York State Department of Commerce sponsored a conference on Automation and Industrial Development to consider "automation in industry with primary reference to its implications for industrial management and for the economy of the State of New York."

These governmental inquiries and surveys, as well as the studies made by labor and industrial organizations and the conferences and reports of trade and management associations, have served to identify and project many of the problem areas of automation. Periodicals, such as *Business Week* and *Fortune,* have also contributed to the published materials currently in circulation.

Most important and complex are the problems which pertain to the worker. Among these are the possibility and extent of displacement and unemployment, the need for training for upgraded skills and newly created jobs, the shift of employment opportunities, the reduction in the work week, and the effects on the health and welfare of the worker.

There will be a displacement of workers in both factories and offices, but the actual rate of displacement on the whole appears to be relatively low. Many displaced workers will be assigned to other

jobs requiring higher skills, some may be transferred at the same wages to assembling, shipping, or maintenance work, others may be downgraded. Many displaced workers will be absorbed by normal turnover during the transition to automation. Displacement will also have a serious effect on future job seekers, since a number of job opportunities now available will disappear with the spread of the new technology.

To a large extent the effects of displacement will be offset by the creation of new jobs, existing personnel shortages in certain technical fields, and increased demands for maintenance workers, engineers, electronics experts, electricians, mechanics, pipe fitters, toolmakers, analysts, programmers, supervisors, and management personnel. More salesmen will be needed to dispose of the increased output. The atomic energy, guided missiles, chemicals, plastics, and electronics industries are now seeking more workers, despite gains made in automation. Nevertheless, displacement, even in generally favorable economic circumstances, may result in readjustments and hardships for large numbers of workers.

Training programs will be required to prepare workers to fulfill new job responsibilities. With so many changes taking place, narrow, specialized training may prove to be a handicap for future job requirements. As Professor Peter F. Drucker has stated, "under automation a school could do a student no greater disservice than to prepare him for his first job."[1] Hence, existing patterns of education and vocational preparation will probably require revision. The shortage of engineers and scientists, which is becoming more acute as automation advances, not only presents a problem of training at the college level, but raises questions as to the adequacy of high school training where fundamental skills in science and mathematics are begun. The recruiting and preparation of teachers in these subjects also require attention.

Organized labor is seeking a shorter work week, longer vacations, earlier retirement, and longer schooling as ways of sharing in the rising productivity and of maximizing employment opportunities.

Consideration must be given workers who face special difficulties in obtaining jobs. It may become necessary to find new job oppor-

[1] Peter F. Drucker, "The Promise of Automation," *Harper's Magazine*, 210:41–47, April 1955.

tunities for the physically handicapped. If workers are too old to adjust to new jobs they may be forced into retirement before they reach the age of sixty-five.

Automation may open up new vistas in industrial medicine. While a reduction in accidents and chronic disease is foreseen, an increase is anticipated in new and intangible problems that may affect the health of people on and off the job. A shorter work day or work week will necessitate greater emphasis on health maintenance programs, including home safety, health education, and counseling. Automated industry, with its trend toward more and more skilled work, should be concerned with the effects of mental and emotional stress on its workers.

From the foregoing observations of the potential and reported effects of automation on the worker several implications for public administration may be deduced. The need for review of social security and unemployment insurance systems to ascertain their adequacy becomes obvious. Free governmental placement services may require expansion. The sufficiency of government-subsidized and -operated training and educational facilities should be studied. The Social Security Act may need amendment to provide earlier social security payments to workers forced to retire before the age of sixty-five. Governmental mediation and conciliation services may face reorientation.

Increase in leisure time will create demands for expansion of recreational facilities such as parks, museums, and public libraries. Public health, welfare, and educational programs may need enlargement and supplementation to meet pressures induced by the consequences of automation.

Although the implications which emerge from an analysis of the effects of automation on the workers are extensive and serious, they do not call for charting unexplored areas of public administration. Both the philosophies and machinery of government involved in the effective handling of the problems are well established and in full operation. Federal, state, and local governments have long been committed to finding and providing solutions. Under the Employment Act of 1946, both the legislative and executive branches of the Federal Government are charged with the responsibility to adopt and maintain a high level of employment.

It is also important to note that the Subcommittee on Economic Stabilization of the Joint Congressional Committee on the Economic Report stated in October 1955 that its

> best and by far the most important single recommendation . . . is that the private and public sectors of the nation do everything possible to assure the maintenance of a good, healthy, dynamic and prospering economy, so that those who lose out in one place as a consequence of progressive technology will have no difficulty in finding a demand for their services elsewhere in the economy.[2]

Other problems which will necessitate continuing governmental attention will include provision of adequate public services to accommodate the conversion, movement, and relocation of factories and offices, protection of the consumer interest, and assistance to small business.

The conversion, movement, and relocation of automated factories and offices will affect the planning and regulatory functions of municipal and local governments. Layout changes required by automation may necessitate building structures of a pattern different from those now in existence. Zoning, building codes, and licensing requirements may need revision. Typical of governmental approach to the problems raised are the studies of efficient land use, zoning requirements, and desirable transit patterns and facilities conducted by the Department of City Planning of the City of New York. In its April 1956 *Bulletin,* this agency published the results of recent surveys and projections "in keeping with the new technological developments and economic currents." The implications of automation for municipal governments are embodied in the *Bulletin's* statement that "a knowledge of changing employment volume, composition, and location, and a realistic appraisal of the level of employment in 1960 and 1970, can be exceedingly helpful in suggesting solutions to vital city problems concerned with future commercial and industrial needs."

Protection of the consumer interests involves continuing governmental studies of purchasing power and price trends, expansion or contraction of markets, shifts in the scale of consumer preferences, and changes in the consumer price index. Many adjustments

[2] From hearings of Subcommittee on Economic Stabilization, a subcommittee of the Joint Committee on the Economic Report, Congress of the United States.

will undoubtedly result from the introduction of new products and services not available or possible before automation.

For small business there will be gains as well as problems. The comparative adaptability and flexibility of small business, and the demand for components and parts for the new machines, will benefit many small firms. Drucker believes that automation should strengthen the competitive position of the small company, "if only because mechanical machine-setting enables the small organization to offer a more complete and diversified range of products at a competitive cost." He believes, too, that automation "will create opportunities for countless businesses to specialize in servicing equipment."[3] On the other hand, many small firms will find it difficult, if not impossible, to meet the challenges of automated competitors. Governmental programs for assisting small business may require augmentation to finance and counsel new and expanding enterprises, as well as existing companies facing bankruptcy or failure.

Continuing research on the progress of automation and its implications and provision of additional services and facilities may necessitate increased governmental expenditures. This may well be the most serious and vexing of all the external implications for public administration. The solution may lie in the internal implications of automation.

Internal Implications

Interest in automation is but another manifestation of the drive for better management in government which has received tremendous impetus in recent years. The Hoover Commission studies of the Federal Government, the comprehensive review of the City of New York by the Mayor's Committee on Management Survey, and similar studies of state and local governments throughout the country, give ample testimony of the intensive search for more efficient and more economical public administration. Motivation for this search is found not only in the growing complexity of government, increasing demands for new and expanded services, and the concomitant rise in operational costs, but also in the prevailing

[3] Drucker, *op. cit.*

philosophy that "good government is good politics." Automation appears to offer many of the solutions sought. It also presents numerous problems which must be met to make it work effectively.

The key to successful application of automation is adequate planning which entails thorough study and analysis of all of its aspects. Realistic rather than dramatic thinking is called for. Published findings of studies and experiences of both private companies and governmental agencies reveal a multiplicity of areas which should be probed. For the purposes of this paper, six of the principal areas will be considered: applications, systems and procedures, organization, personnel, costs versus savings, and approach.

APPLICATIONS

Continuing study of potential and actual applications of automation is an essential phase of planning to achieve the benefits which can be derived from the new technology.

Although the "Detroit" and "feed-back" types of automation may ultimately be used in the operation of such governmental facilities as electric power plants, transit systems, and repair stations, integrated data processing offers the most extensive potential because of the nature of most governmental activities.

From experience and surveys thus far recorded, applications of electronic computers to data processing may be classified generally into accounting, procurement, inventory control, production scheduling and control, document handling, scientific and engineering analyses, and management planning and reporting.

Accounting applications include payroll, billing and accounts receivable, disbursements and accounts payable. Recent studies by General Electric and other companies point to the feasibility of preparing budgets on the computers. A number of government agencies are now considering these applications as well as the possibilities in tax assessing and collection, and appropriation accounting.

Procurement, inventory, and production scheduling and control applications are in the planning stage or in operation in a number of governmental agencies. The Army Ordnance Tank–Automotive Command recently installed a computer to control stocks of tank and auto parts all over the world. The Air Materiel Command uses

a computer in the procurement, supply, storage, and issue of materials. The Planning Section of the Air Force prepares assignment schedules of all aircraft and determines supply requirements with a similar system. The New York City Transit Authority will shortly install a number of electronic machines to control its inventory, now valued at $15,000,000.

Electronic document handling, involving the processing, sorting, and delivery of records and authorizations, is currently being studied by several groups with a view toward reducing substantially the costs of such clerical operations. Initial attention will be directed toward the processing of checks. Applications in this category offer a vast potential for government operations.

Typical of scientific and engineering applications are the computations for map making by the Army Map Service, and the analyses made by the Atomic Energy Commission in the design and construction of power and research reactors. The Bureau of Public Roads of the United States Department of Commerce is planning to use computers for computations for earthwork and bridge and hydraulic design. The Weather Bureau uses computers in weather forecasting.

Management planning and reporting applications involve the processing of various types of interrelated data to aid management in developing forecasts and making basic decisions. Such processing is generally characterized as operations analysis. In this category may be placed the Federal Bureau of the Census activities which use electronic computers to project population data, economic and industrial statistics in a variety of classifications, and indices. Such applications will make possible the compilation and issuance by governmental agencies of more adequate and more timely reports of data of major significance and value in constructing business barometers.

Integrated data-processing techniques offer many possibilities for facilitating and improving governmental planning. The various factors affecting budgeting, such as income to be realized from various sources, objectives to be achieved, and expenditure distributions, might be integrated to simplify and expedite budget preparation and control. Integrated processing of population statistics, employment trends, industry migration patterns, available land areas,

zoning restrictions, transit schemes, tax rates, and other pertinent data would not only cut years from planning time, but would also greatly enhance the end results. Similarly, planning for schools, health and welfare centers, hospitals, sanitation districts, and police and fire stations would be simplified and made more effective and more economical by coordination through the medium of electronic computers.

Another fertile area for automation lies in the field of intergovernmental relationships. Coordination of federal, state, and local government activities in the administration of such functions as health, welfare, and education could be made more effective through integrated processing of data of common interest and significance. Automation can also make a major contribution to the solution of regional problems of city and local governments in metropolitan areas through integration and coordination of interrelated data. An equitable sharing of the costs entailed would make possible the utilization of automation techniques by the smaller governmental entities which could not otherwise afford them.

While the foregoing are only a few of the examples of actual and potential applications of integrated data processing in public administration, they should serve to point up the essentiality of thorough and intensive study before such applications are effectuated.

SYSTEMS AND PROCEDURES

Complete analysis of systems and procedures must precede determinations of the advisability of a change-over to integrated data processing and development of the programs to be fed into the computer. Every procedure will have to be examined closely for its essentiality and logical sequence, because the elimination of a single step may save hours of complex programming and expensive machine time. It is also conceivable that the addition of one line of data in an integrated system may obviate the need for setting up or maintaining a separate bank of information in one or more departments.

Although systems and procedures analyses will entail the expenditure of thousands of man-hours, there are many benefits to be

realized from simplification and improvement even if it is found that electronic processing is not feasible or advisable.

ORGANIZATION

Existing organizational patterns will require extensive study to ascertain the need for revisions as data processing is integrated. Since the new technique will, in many instances, cut across and obscure existing departmental lines, it may become necessary to revise the division of functional assignments, and to eliminate some departments and create others.

The high speed of automated operations will necessitate the creation of an organization capable of moving fast, primarily because of the substantial costs of lost production time. Centralization of data-processing facilities, which in most cases will be a basis for their justification, will not only make possible but will require decentralization to the lowest possible levels of decision-making authority. Top-management planning will, therefore, have to anticipate deviations from basic policies and provide reasonable guides to direct action when deviations are necessary. The inflexibility of data processing will also call for more and more decentralization of decision making.

An insurance company recently reported that automation of its operations resulted in "decentralized centralization." Centralization was characterized by home-office control of practically all operational functions. Decentralization was effected through the rapid development of branch offices and the allocation to them of greater administrative responsibilities. As a result, field offices were able to offer faster and better service to policyowners.

Decentralized centralization in government may be illustrated by applying the concept to a public school system. Public school principals would be authorized to make decisions and take required action affecting their respective schools in conformance with centrally established policies and standards. Expeditious decision making and action by the principals would be made possible and would be based on centrally produced data. Such data would include school population, health conditions, attendance levels, utilization ratios, and other pertinent factors for each unit in the

school system. Analysis of comparable data for all the schools would be an important guide to decisions at each school. An electronic computer at school headquarters would be the core of such an organizational pattern for which rapid production of up-to-the-minute information would be the prime essential.

As yet no general pattern has been evolved as to where the computer installation should be placed in the organization, although various arrangements have been tried. It seems obvious, however, that automation will lead to many changes in organizational concepts of public administration.

PERSONNEL

The most challenging aspects of automation will be the human rather than the mechanical. The effects on government personnel will be as extensive and ramified as those previously considered in connection with the external implications.

Problems of displacement, upgrading, transfer, and training must be met and solved. The content of jobs affected by automation and job evaluation and classification plans will require close scrutiny. Recruitment and training for new jobs created by integrated processing will present problems.

An important guide in approaching the personnel situation is contained in the report of the Subcommittee on Economic Stabilization of the Joint Congressional Committee on the Economic Report. This report, which may be considered a mandate to the Federal Government, states that "when in the interests of economy and efficiency, the Federal Government finds it necessary to displace faithful employees, the Subcommittee feels it must be a model employer in handling personnel problems such as retraining, reassignments, and severance allowances." The principle here enunciated may serve as a guide for state and local governments, too.

During the early part of 1956, the United States Civil Service Commission undertook a survey of the effects of automation on federal employees and federal personnel practices. Referring to this survey, John F. Powers, president of the New York State Civil Service Employees Association, in an article in the *Civil Service Leader* of May 8, proposed that "it might also be well if the [New York] State Commission, like its federal counterpart, could conduct

some preliminary surveys as to the probable effects [of automation] upon civil service personnel."

In a special release published in the *New York World-Telegram and Sun* on May 23, James A. Campbell, president of the AFL–CIO American Federation of Government Employees, called upon federal agencies to adopt a "more human approach to the problem of automation." He proposed a policy statement pledging maximum job protection, a general policy of training present employees to operate automation devices, and advance planning for retraining or reassigning affected employees.

In the central office of the Veterans Administration, classification and qualification standard technicians are working with departmental and Civil Service officials to "visualize the type of positions which would be involved, the definition of an appropriate series and methods whereby individuals to be engaged in electronic data-processing and allied fields may be identified, trained, developed, appropriately assigned, and adequately paid."

The growing awareness of the personnel problems which automation will pose emphasizes the seriousness and extent of this major area of the implications for public administration.

COSTS VERSUS SAVINGS

Careful and detailed cost studies and projections of possible savings should be made before decisions are reached to change over to integrated data processing.

In estimating costs, consideration should be given not only to the expenditures for equipment but also to the costs involved in the analysis, planning, and development which must precede the installation of the new systems. Recruitment and training of personnel and, where necessary, new locations to accommodate the new equipment, should be included in the estimates. Operating costs, including more exacting maintenance requirements, of the new systems should be scrutinized. Costs will vary with the extent of automation, the time required for planning and installation, the types of machines to be used, and decisions to rent or buy the machines.

Indications of the cost potential for government may be gleaned from recent studies in the oil and insurance industries. A recent

survey of twenty-five oil companies which have installed electronic computers revealed that preparatory costs ran between $150,000 and $1,500,000, in addition to equipment costs which ranged from $32,500 to $4,500,000. At the Life Office Management Association's Annual Conference last year, it was reported that costs, even for a modest installation, may range from $1,000,000 upwards, and that the eventual cost of a large computer installation will be calculated by the volume of work it processes.

Projections of savings should encompass intangible as well as tangible results. Although reductions in labor costs will be substantial, experience has shown that such savings will be neither the only kind nor the most important. In many instances it has been found that labor savings were insignificant compared to savings resulting from improved quality of product, greater productivity, and faster and more effective planning. Major economic benefits are also to be derived from the ability to perform more and better services at practically no increase in cost.

Many of the questions which appraisals of costs and savings will raise may not be answered for several years, since some answers can be discovered only when the new system is in full operation.

In the study of costs and savings very serious attention should be given to the impact of automation on government budgets. Problems will be encountered in providing funds for planning and installing the new systems. Justification for the necessary expenditures may also present problems, because resulting savings will probably not be reflected in subsequent budget reductions. Mitigation of the pressures which may be expected in opposition to the expenditures will depend on the extent to which present budgets will be stretched to include new and expanded services and improved performance.

Provision of additional and better services, without spending more than present budgets allow, may prove to be the measure of success in meeting the external and internal implications of automation for public administration.

APPROACH

Since automation of governmental operations will, in the main, mean integrated data processing through electronic computers,

integration and coordination should be the guiding principles of the approach to the new technology.

The first step should be directed toward integration and coordination of thinking and planning. A top-level committee, representative of the entire governmental structure, should be designated by the chief executive to study over-all aspects of automation, and to develop the basic philosophy, principles, objectives, and yardsticks upon which change-over decisions should be made. Departmental committees should be set up to study the implications of automation within individual departments and to report, through their respective department heads, to the central committee. These committees should be composed of specialists trained in the fundamentals and applications of automation. Top-level coordination and interdepartmental cooperation will greatly facilitate the exploration of interrelated systems and the promotion of effective utilization of available manpower.

Typical of this approach in government is the action of the Governor of Puerto Rico, who last year appointed a committee to study the implications of automation and report its conclusions to him. This committee, in turn, organized a survey team of government employees trained in data-processing techniques. Private industry, in general, has followed this approach.

In the conduct of planning surveys it is important that the approach be cautious as well as progressive. Government, like business, should be on guard against embracing automation because it is in the current mode or because its miracles are wonderful to behold. In addition to the costs entailed, there are limitations and risks which are inherent in automated systems and which should be carefully explored. For example, electronic systems impose a heavy dependence on equipment and on a very small group of key personnel. Equipment failure or loss of key personnel may result in serious operational breakdowns. Provision must therefore be made for coping with such contingencies.

The ultimate product of the planning committees should be a master plan in which all feasible and justifiable applications would be blended into an over-all, integrated management control system. This should also include a time schedule for preparatory actions and for effectuating installations.

During the planning and transition stages, which may require a minimum of two to three years, the committees should issue reports of progress for the benefit of government officials and personnel, as well as the civic associations and employee organizations, who will be following the developments with intense interest.

The possibility of borrowing experts from private industry to aid the planning committees should be explored.

Establishment of a central clearinghouse for the compilation, dissemination, and interchange of the vast amount of pertinent literature currently emanating from a variety of sources would greatly facilitate the research which is entailed in planning. Invaluable assistance toward this objective could be rendered by such groups as the American Association of Planning Officials and the American Society for Public Administration. Already active in this field is the Municipal Finance Officers Association of the United States and Canada.

Summary

The implications of automation for public administration may be divided into two classifications, external and internal. In each of these classifications the impact of automation will be extensive and will require thorough and careful study.

External implications will emerge from the economic and social problems which industrial and commercial applications of automation will create. Of primary significance will be the effects on the worker; displacement, training, shifts of employment opportunities, and reduction in the work week are some of the factors involved. Conversion and relocation of factories and offices, and effects on the consumer and small business are other areas of government concern. To offset the pressures of automation, government may find it necessary to revise social security systems; enlarge educational, health, and welfare programs; provide more recreational facilities; modify master plans of cities and localities; and expand programs for aiding small business and guarding consumer interests. Increased governmental expenditures may be required to provide the new and expanded services.

Internal implications will stem from application of automation

to the operations of government departments and agencies. In the main, automation in government will mean integrated data processing. Successful utilization of the new techniques will depend on the adequacy of planning. Actual and potential applications should be explored, thorough analyses should be made of organization, systems and procedures, and effects on personnel. Costs and savings should be carefully projected. Financing of preparatory and installation costs will present problems. It is doubtful that automation will result in reductions in government budgets. Major benefits will probably be reflected in more and better public services, possible only through automation, without substantial budgetary increases. Integration and coordination, as well as caution, should be the guiding principles of the approach to automation. Top-level coordinating committees, working with departmental committees, should integrate planning and decision-making functions. While automation appears to offer a vast potential for government, change-over decisions should be based on feasibility, costs, operational limitations, and adequate justification in terms of savings and real benefits.

Digest of Definitions and Concepts of Automation

The word "automation" is generally credited to Delmar S. Harder, executive vice-president of Ford Motor Company, and John Diebold, head of a management consulting firm in New York. These two men conceived the word independently, but at the same time, during 1948. To each one, however, the word meant a different type of automation.

To Harder, "automation" originally meant the mechanization of the handling of parts between machines in successive productive operations. Subsequently, this definition was expanded and enhanced to "the completely automatic and selective transfer of a part from one processing operation to another, the qualification and selectivity being the distinctive mark of automation." This is sometimes referred to as "Detroit automation" because it is best exemplified by the block-long machine systems in the automobile plants. It has also been called "continuous automatic production," characterized by the combining of automatic machines with transfer or handling equipment.

To John Diebold, "automation" is primarily "automatic control." His operational definition envisions automation as "a means of analyzing, organizing, and controlling production processes to achieve optimum use of all productive resources—mechanical and material, as well as human." Fundamentally,

according to Diebold, automation is "a science of communication and control." In addition to "Detroit automation," he distinguishes a second type which he calls "feed-back automation."

"Feed-back automation" consists of a self-correcting control system characterized by a closed loop between output and input. In this system the result of an operation, or output, is fed back for comparison with the input. If a discrepancy or error is detected, the necessary correction or adjustment is made automatically within the system, without human intervention. The simplest example of such a system is the thermostat which feeds back an electrical signal to the input, if the temperature is either below or above the desired level, to make the required correction. The thermostat acts to start or shut off the furnace.

The feed-back concept of automation is based on the science of "cybernetics," expounded in 1948 by Dr. Norbert Wiener of Massachusetts Institute of Technology in his book, *The Human Use of Human Beings.* Dr. Wiener, who was the first to explore the philosophical aspects of the new technology, wrote: "We ordinarily think of communication and of language as being directed from person to person. However, it is quite possible for a person to talk to a machine, a machine to a person, and a machine to a machine."

The type of machine which Dr. Wiener foresaw is today variously known as the automatic computer, electronic computer, electronic data-processing machine, and integrated data-processing machine. Because of Dr. Wiener's comparison of the feed-back mechanism with the human brain, the computer has for several years been called the "giant brain." With the realization that these mechanical monsters cannot think for themselves, but can perform only as, how, and when directed by human beings, the fearful "giant brain" nickname is gradually being replaced with such more endearing terms as "spinal cord" and "supersonic moron." It is reassuring to note that Dr. Wiener no longer views automation as a force which would reduce wage earners to "slave labor," as he did in 1950. He now sees man becoming automation's master, and predicts that automation will increase man's leisure and enrich his spiritual life.

From the core of Harder's and Diebold's definitions and concepts have evolved a number of clarifications inspired by recent technological developments. Some of these clarifications are simple, some are complex, some may appear to contradict others. They indicate why *Fortune* magazine called the definition problem acute, why the Armour Research Foundation has sought to "stabilize thinking" about automation, and the nature of the task of the committee of the American Standards Association which is working on a standard definition of automation.

Professor Peter F. Drucker defines automation "simply though superficially as the use of machines to run machines. . . . It means," he says, "that materials handling, routine judgment, machine setting, and data processing are done by machines."

Professor Harold W. Martin, of Rensselaer Polytechnic Institute, describes automation as "the entire accomplishment of a work task by a power-driven, integrated mechanism wholly without the direct application of human energy,

skill, or intelligence." In an elaboration of this definition, Professor Martin sees as the essence of automation "the replacement of human labor, through delegation of productive work, materials movement work, and routine control work to a combination of power-driven materials movement, materials processing, and process control equipment, integrated into a coordinated mechanism."

To Don G. Mitchell, president of Sylvania Electric Products, automation and mechanization are "really one and the same thing. Automation is only a more recent term for mechanization which has been going on since the industrial revolution began."

Robert K. Mueller, a vice-president of Monsanto Chemical Company, suggests that automation might better be called "an industrial system starting with basic raw materials and ending with the final product, completely integrated, functionally related, controlled by a mechanism programmed for a specific family of products, and so designed that it will correct without human intervention for internal or external disturbances within the parameters around which the process is designed."

Robert T. Collins, general sales manager of the New Departure Division of General Motors Corporation, defines automation as "the characteristic of continuous self-motion and self-control in industrial operations. It signifies the mechanization and self-regulation of the processing, materials handling, and inspection functions of an entire operation."

Milton Aronson, editor of *Instruments and Automation,* calls automation "the substitution of mechanical, hydraulic, pneumatic, electric, and electronic devices for human organs of decision and effort."

The Department of Scientific and Industrial Research of the British Government has defined automation as "the confluence of four independent streams of technical progress. These are mechanization, including transfer machines; mechanical handling and assembly; electronic devices that control machinery and various processes; and electronic computers."

In the field of paper work and record keeping, automation is generally referred to as automatic, electronic, or integrated data processing. The heart of the data-processing system is the central processing unit called the computer. Because the preparation of information to be fed into the computer is still a "human function," data processing in its entirety is not wholly electronic in concept at the present time and automation in data processing has not as yet been achieved. Encouraging progress is, however, being made to overcome the limitations of input preparation equipment.

Summarizing the various definitions now circulating, *Fortune* magazine concludes that none of them "refers to anything that cannot be covered by the word mechanization—that is, replacement of men by machines. What complicates mechanization concepts today and has let automation into the language without clear meaning is, apparently, one fact. Two human functions are theoretically replaceable—the providing of energy and the handling of information. Mechanization has long been replacing the first, and now it is replacing the second at an impressive rate."

3

AUTOMATION—IMPLICATIONS FOR SCHOOLS

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WHETHER AUTOMATION HERALDS the second industrial revolution, as some claim, or the fourth, as other students hold, is of less concern to education than the fact that all revolutions—economic, political, or of whatever nature—are themselves but incidents in an endless evolution. Every society is constantly in a state of becoming, and its members who carry responsibility for educating the young must be particularly aware of the direction in which this evolution is progressing. Keeping the school abreast of cultural change in a static society is not difficult; but in a culture like ours, where change often occurs at a breathtaking pace, its implications for education are enormous.

To appraise the significance of automation for education, it is therefore necessary to view this new phenomenon against the total evolutionary process of which it is a part. Watt's steam engine, which made possible the first industrial revolution, was an earlier symptom of the same broad trend of which Univac is a current manifestation. Both machines were invented to conserve human energy, to magnify the effect of the human mind, to serve more efficiently the aspirations that motivate men.

The industrial changes of the eighteenth century were focused upon achieving a better life—primarily for the factory owner and the financier. But in the ensuing two centuries the rise of democracy and, most notably, the popular extension of economic opportunity

have altered the focus substantially. Now as automation arrives with its companion development, the industrial use of atomic energy, they are being viewed not as the dawn of a new day for the capitalist, but as the promise of a still more abundant—and more leisurely—life for the average man and his family.

The industrial engineers employ vacuum tubes, transistors, and relays to control the manufacture of engine blocks, but the ultimate social end their efforts serve is not merely the production of more or better motor cars; it is the more complete liberation of the minds and spirits of men.

The growing use of serve-mechanisms and computers in industry and the consequent reduction in man-hours required per unit of output are closely related to education at a number of points. Some of these relationships have been frequently noted and well publicized. Others, not yet so obvious, have received less attention than they merit.

Best known, if not always well understood, is the current shortage of scientific and technical manpower. For this condition the schools are usually expected to provide a solution and are often asked to accept the blame, but there is clear consensus that the schools have a major contribution to make. There is somewhat less agreement upon how the scientist should be prepared, how the cost of his education is to be met, and where the augmented supply of scientists is to be found.

Less well publicized is the steady decline in the need for unskilled and low-skilled workers. While this trend continues and is being accelerated, larger numbers of unskilled and uneducated people are flocking to our major industrial centers. This obvious and growing imbalance of jobs and people raises urgent questions for educators, public officials, and others who are concerned about the broad-scale welfare of the people and particularly of those resident in the big cities.

A concomitant of the reduction in the unit man-hours needed to produce what the economy can absorb has been the increase in the amount of leisure time at the disposal of the worker and his family. This and the general elevation of living standards of which it is a part have caused a heightened demand for recreation and services of various kinds. As the life of the average citizen has been less

dominated by his job, subtle but profound changes have occurred in family life—in the relations of husbands and wives, of parents and children. These changes are reflected in school programs in varied ways, but few would argue that the schools deal with them adequately.

Better-paid workers not only buy more goods but also purchase more and more diversified services. It follows that the service occupations will grow in size and importance. Employees in these fields often need less technical skill than those who construct and operate manufacturing machinery, but virtually all service workers must possess skill and sensitivity in human relations. Whether the schools have taken this fact sufficiently into account is open to some question.

A possible effect of automation upon schools, which has not yet received adequate study, centers about the problem of technological change and the resulting dislocation of employees. Economists contend, and labor leaders agree, that in the long run conversion to automatic operation may be expected to yield more jobs and a higher general standard of living. For the short run, however, many workers are likely to be displaced for varying periods of time. Some of these people will have to find work in other parts of the country. Some will have to develop new skills or upgrade their old ones. How much of the required retraining is to be done within industry and how much by the schools or other agencies are yet to be determined. That the schools will be called upon for some part of this task seems inevitable. Important questions of public policy will be involved and the effect on adult education is likely to be great.

If these assumptions have any validity, school administrators will need to be aware of the emerging economic changes and prepared to take them responsibly into account in the operation of schools. These changes will impinge upon the schools differently in different places. While the timing and intensity of their impact will vary, sooner or later everywhere they will affect the formation of basic policy, the nature of the instructional program, the professional preparation of teachers, the patterns by which schools are organized and administered, the ways they are financed, and, at every point, their relationship to society in general and to the people of the school district in particular.

BASIC POLICY FORMATION

If American education is to serve the nation well in the decades immediately ahead, fundamental educational policy will have to be well conceived and soundly based. And if this is to be achieved, those who make that policy—local boards, state authorities, and, in increasing degree, national agencies—will need the soundest possible data upon which to base their planning. Such data have not always been available in the past, especially to local school boards.

Moreover, neither the boards nor the administrators to whom they look for guidance have very often sought such information. The relation of school planning to social and economic trends has usually been anything but deliberate. More often than not, school authorities have found themselves running so hard to catch up with past changes that they have had little time to contemplate what the future might bring.

The practical as well as the theoretical problem is how to maintain a good dynamic balance between ready adaptability on the one hand and a decent respect for stability and conservatism on the other. There can be little question that the tempo of social change has quickened and that the rate of educational change must be altered correspondingly.

To support more rapid policy adjustment, and especially to relate it to oncoming developments, school authorities must have better sources of data and better access to those sources than now exist. Since administrators and other professional leaders will be the indispensable links in the communication network serving school boards, it follows that these key leaders will have to be well prepared for the function of finding, interpreting, communicating, and using information in a wide variety of fields.

Data will not be enough. Many of the decisions involved in school policy determination necessarily are based less on concrete fact than on informed and experienced judgment. Often the factors to be taken into account lie outside the specific areas of pedagogy, public finance, or educational administration. The specialized problems related to automation, for example, are chiefly within the purview of the industrialist, the labor leader, the economist, the sociologist. It is reasonable to assume, therefore, that school

boards and professional schoolmen will profit from the discussion of these matters with such experts.

Without diminishing either the legal responsibility of the school board, or the professional authority of the superintendent, consultation by school people with representatives of other disciplines can contribute much to the understanding and solution of major policy problems. This is no new idea, but rarely has a school board provided the means for establishing such arrangements in a permanent, continuing fashion. Seldom does a board recognize this function as an established part of normal operating procedure.

THE PROGRAM OF INSTRUCTION

The central business of the school is instruction. As the age of automation and the atom opens out ahead the schools must reappraise their instructional programs to determine what changes may now be required. No less than in the past, schools will continue their efforts to prepare young people for creditable performance in the world about them. But to execute their task well the schools must determine how the coming changes in industry are likely to alter the social and economic environment and its demands upon people.

Whatever new forces or conditions the schools will have to face, much of what they now do will be as important tomorrow as it is today. Children will still need to master the skills of reading, writing, listening, and speaking. They will require an understanding of history and geography. An acquaintance with the physical and biological sciences and skill in systematically applying data and thought to the solution of problems will lose none of their present value. The need to understand quantitative relationships and to have a reasonable facility in working with numerical ideas will assure mathematics a continuing place in the curriculum.

Preparation for healthful living, sharpened aesthetic sensitivity, some awareness of the so-called practical arts, including those of the homemaker, will be as desirable in the new era as they are now. In short, much of what has long constituted good education will continue to be good, for neither automation nor the atom will alter the basic drives of men and women or the fundamental nature of society.

But the ways people use their time and some of the specific

competencies required of them are certain to change. The relative emphasis placed upon traditional subjects will have to be reviewed and altered. Traditional approaches will be questioned and new elements will be added to school programs.

Possibly the most urgent adjustments facing the schools are those needed at the extremes of the intellectual scale. There seems little doubt that the call will continue for more and better-prepared young people to fill high-level jobs in scientific and technical fields. The rise in the percentage of the work force employed in these fields is a sustained, long-term trend. Clearly, school programs must be adapted to this fact.

During the same years, however, that the demand for top-level personnel has risen, the number and percentage of jobs requiring only low skill have just as steadily declined. The easy out that schools have had in the practice of releasing early those pupils who find both abstract and concrete learning difficult will no longer fit the facts of economic life. As this conflict between past practice and emerging need becomes more apparent another set of adjustments will be forced upon the school. Indeed, in many communities, the problem is already upon us and dramatized by large numbers of young people out of school, poorly educated, irregularly if at all employed, and frequently in trouble.

At the other extreme, the schools are being accused of failure to educate well enough their ablest students. Some of this criticism has been ill-founded and the defense against it proper. But other parts of the criticism have been sound and the explanations have often been less than satisfactory. Many schools have attempted to rationalize in philosophical terms errors both of omission and commission. Among the least defensible positions is the one that holds it somehow undemocratic to make special provision for children with outstanding potential, or generally to encourage excellence in achievement.

Clearly one of the current challenges to educational leadership is the urgency of developing in schools a climate favorable to high attainment. The charge that many of our schools lean toward mediocrity is unfortunately too true, and wherever this judgment applies, the nurturing of each pupil's best possible growth will continue to be difficult and improbable.

In addition to the question of basic philosophy, however, serious

practical dilemmas arise. It is not easy in a high school of two hundred pupils to organize a senior section in calculus, or to carry the work in English composition for the brightest half dozen well beyond the level of the class median. But the toughness of the task is not an acceptable excuse for failing to get on with a job that obviously must be done.

There are additional reasons why the cultivation of constructive differences should receive stronger support in schools. In a society devoted to the large-scale production of uniform units of all kinds of things the tendency to massism is always a real and present danger. If our new potential for productivity is to be the servant rather than the master of humanity, the transcendent human values must be promoted deliberately. This can best be done by a thoughtfully zealous and continuous concern for each individual. With a determination now characteristic of only the best schools, all schools will have to find better ways to identify and cultivate the aptitudes of every pupil, to build his skill and knowledge, to develop his taste, and to sharpen his sense of personal moral responsibility. Only as schools do these things will they prepare the ablest youths for the tasks awaiting them and generate in all young people the resilience and fortitude necessary to resist an unthinking conformity.

Another whole group of questions affecting the curriculum centers about the relationship of general education to specialized instruction and the wise balancing of the two. A case in point is the matter of vocational education—especially in the field of trade and industrial training. Quite probably, the coming of automation will focus stronger attention on this segment of education, for among the categories of workers in shortest supply will be the highly skilled craftsmen. The people who can be replaced by automatic equipment are largely the lower-grade machine operators or semiskilled assembly-line hands. The number of places for highly skilled toolmakers and versatile machinists is already on the rise. Some estimates suggest that four or five technicians should be produced for each engineer. The present production ratio is put at one-half technician per engineer graduated.

The education of such highly skilled workers is not to be accomplished in a "crash"-type program. Vocational schools will need

to adapt their programs to produce young men not only well versed in the fundamental skills of their crafts, but prepared so thoroughly that they will be able to make creative and imaginative adjustments to the rapidly shifting industrial scene. They will require, moreover, the ability to work well in group situations, to carry responsibility for expensive equipment, and in many instances to supervise the work of others.

Such training cannot be given to students chosen by the negative selection procedures by which many vocational courses are now filled. Neither the lack of academic ability nor an irregular attendance record is an indicator of high mechanical aptitude. School people in responsible positions will be called upon to reappraise both the purpose of the vocational school and the comparative respectability of the skilled technician. While vocational educators and specialists in testing and guidance will have valuable advice to give, the controlling policy decisions will be in the hands of top school executives and the lay boards who rely on them for wise recommendations.

Among the school programs most directly affected by the advent of automation will be the adult education programs. The community college will take on renewed importance as the means for giving advanced preparation in technical fields. There is already a heavy demand in this field for highly skilled people of less than college grade but with more knowledge, skill, and maturity than high school graduates commonly possess. Some of these openings will be taken by young men and women, but thousands of others will be filled by adult workers who have sought retraining and extended their skills.

It seems reasonable to expect also that, as the value of industrial equipment per worker rises, management will seek workers better prepared to carry responsibility for such machinery. While the school cannot completely recondition the postadolescent or adult personality, it can make substantial contributions to the improvement of skills in human relations and the development of better work habits. Preparation for leadership will be likely to assume a more important place among the functions of the school, for as the skill level of the average employee rises, the role of the supervisor

and foreman will also change. All these factors will influence the education of young people preparing for initial employment and of older workers seeking to improve their positions.

The need of the worker for help on his job will be accompanied by a steady rise in the number of his leisure hours. Indeed, we face the challenge of learning to live well in a culture in which the average person's life is no longer dominated by his economically gainful employment. All the cultural institutions must share in the responsibility with which this impending change confronts us, but the school, as usual, occupies a unique position.

Much of what must be done to help men and women become self-sustaining in a cultural sense will have to be done during the period of childhood and adolescence. This challenge imposes no essentially new duty upon the school, for the liberation of the mind and spirit has long been the school's principal objective, but the task now takes on a new urgency. Millions are discovering that freedom from work is a questionable blessing when they lack the resources to use that freedom fruitfully. The schools that should have equipped them for the good use of these hours have frequently failed them.

The school, then, faces a double task. It must work with children to develop in them the attitudes, tastes, and skills for continuous personal development, and it must work similarly with adults who turn to it for help in their mature years.

STAFF DEVELOPMENT

It is pointless to consider what schools should do if one fails to emphasize that the teacher is the essential element in the enterprise. The progress of policy formation may be perfect and the instructional program planned without a flaw, but what happens to the learner will be affected for the better only if the teacher works appropriately with him.

Good teaching in the age of automation will certainly not be very different from good teaching now, but much more such teaching will be needed. The truism will hold with renewed force that the teacher should be first of all a good man or woman, well endowed with the requisite personal qualities, and then broadly educated. But in a period of rapid change it is essential also that

the teacher understand deeply the world he lives in, its effect on his pupils, and the role of education as the great mediating force between the environment and the growing individual.

The best school in the years ahead is likely to be the one whose teachers are abreast of the world, deeply concerned about developing the potential of every pupil, skilled in the art of guiding growth and stimulating learning. This will be the school in which teachers have security, where they are free to build upon earlier achievement to meet emerging problems, where their strength is valued, and their questions respected. Here it will be agreed that professional development is as endless as education itself and the steady growth of the teacher a prerequisite to the continued growth of the pupil.

The beginning of such schools is in the undergraduate programs for teacher education. While no one is completely prepared to teach when he graduates from college, the breadth and quality of preservice education affects to a considerable degree the young teacher's outlook upon his work and the probability of his continued professional improvement. The steady rise in the standards of teacher education in recent years has been all to the good, for it assures the nation a running start on the problem it now faces. But the progress must be continued at an accelerated pace and additional leadership and support given to elevating teacher preparation to a first-line place in the educational effort of the country.

Should we fail to do this, or to do it with sufficient speed, the entire movement toward automation is virtually certain to be retarded. The chief limitations upon the extension of automation are not technical but human.

The rate at which new equipment can be designed, constructed, and installed depends first of all upon the availability of men and women in whom unusual technical skill is combined with creative imagination. Fully to capitalize upon the work of this group another kind of competence is required. The managers and supervisors of automatized plans should be people of broad background with outstanding ability in human relations. They should have the capacity to deal with problems upon which established precedent often casts but little light.

It will not be easy to create a steady supply of teachers good enough to prepare sizable numbers of students for such perform-

ance. The role of teacher education institutions in the development of automation is one of enormous strategic importance.

A heavy responsibility similarly falls on the graduate institutions of the nation. It is to them that experienced teachers will turn for new information and further training to meet the changing demands upon the schools. While teachers in service will continue to be interested in advanced work in child study, curriculum construction, and the specific subjects they teach, they will find growing need for courses in economics, sociology, and other fields of study that will help them to understand and interpret social and economic conditions. It appears quite likely that in setting up graduate programs for teachers and other workers in education, the school of education will have to work much more closely than it now typically does with other branches of the university.

ADMINISTRATIVE PATTERNS AND PROCEDURES

Educational administration comes under great pressure in periods of rapid social change. It is to be expected that as industry seeks higher competencies in its employees, as the community feels the impact of altered economic conditions, the effects of these shifts will be translated into objectives and activities for schools. The educational administrator, more than any other person, will be expected to lead in the process of marshaling educational resources to do the job expected of the schools. Moreover, he will first have to help the community define the task that is to be attempted, and then carve out the part of it that lies within the jurisdiction of the school.

The necessity to state in manageable dimensions the mission of the school merits greater attention than it ordinarily receives. As the role of education becomes even more important than it has been, it is essential that the power of the school be directed to those ends which cannot be as well served, if at all, by other institutions. Conversely, because the school will presumably have its hands full with the job of education, the diversion of any part of its strength to nonessential peripheral interests will only weaken the quality of its educational results. We may quite probably find ourselves shortly seeking a redefinition of education that will assign the schools a mission they can complete with the resources at their disposal.

One effect of such redefinition should be to clarify the relative priority of the functions now performed by schools, relieving them of some of their current activities in the fields of entertainment, recreation, and miscellaneous public works. To include activities in the program of the school merely because they are good for young people can so overload the school that its essentially educational functions will be diluted to the point of practical disappearance.

Such a re-examination calls for discriminating leadership by school administrators. The final decision must be in the hands of the people, but it is the responsibility of the professional educator to remind them of the peculiar nature of the school and to help the public decide wisely how it wishes to use—and avoid the misuse of—its institutions. To play this role well the administrator will have to be a person of stature and wisdom whose rare diplomacy and tact are equaled by his courage.

Beyond the primary task of leadership in identifying goals for schools, the administrator has another demanding job. This is to devise and maintain the patterns by which resources are found, organized, and applied to accomplish the educational purposes that have been agreed upon.

American communities and their school systems differ widely from each other. The ways in which automation will affect them will probably vary even more. It would therefore be irresponsible to suggest that a uniform plan will have any validity. But it may safely be predicted that the communities most likely to make the best use of their schools in meeting the changes of the next several decades will be those whose schools are so administered that they can respond flexibly in making adaptations required of them.

Attention was called earlier to the importance of having ready access to data and expert advice on social and economic trends. Such assistance and the willingness to use it intelligently will be characteristic of the most successful school systems. Practically, this will require not only a well-prepared administrative staff but specific provision in the organization and the budget to guarantee adequate research service and effective means to transmit the information gathered to the community and the teachers. In larger systems such arrangements will be possible locally. In smaller districts the service required will have to be furnished by intermediate

units or by the state educational agency. It goes without saying that close liaison with the research work of graduate institutions and other public and private agencies must be a basic part of any such program.

The involvement of lay groups in the development of curriculum plans and materials is now an accepted practice in American education, but the practice will need to be further extended and improved to meet the instructional problems of the future. To a greater degree than is now common, representatives of community agencies, especially those in closest touch with the changing social and economic scene, will have to be kept in almost continuous contact with instructional programs. Through these relationships two major purposes will be served: new objectives and procedures will be identified, and existing ones will be subjected to constant scrutiny and evaluation.

Additional problems for administrators will arise within the professional staff itself. Indeed, the test of the entire administrative structure will be as it has always been—the extent to which it facilitates the learning and growth of pupils. Much of the result will depend upon the spirit that permeates the entire staff. One major part of such spirit is a sense of unity and common purpose; another is the feeling of freedom within the group. While the administrator, Janus-like, faces the community with one half of his nature, with the other half he faces his staff, giving it the strong professional leadership that always must come more from his own qualifications than it ever can from his official status.

To create this spirit and to build the strength in competence that gives it real meaning will require the best of communication within the staff. To clarify purposes, to increase knowledge and skill, and to evaluate results, a free and easy flow of ideas throughout the staff will be essential. The usual statement that good communication is a two-way process will be inadequate, for the pressing need to exchange information will not permit limitation to an up-and-down concept. To meet the exigencies of the future it will be necessary to plan specifically for the dissemination of ideas rapidly in all directions, within the schools and between schools and other agencies.

Not the least of the matters with which the administrator will

have to deal will be the clarification of board–staff–community relationships. Whenever a need for rapid change in schools is felt in the community, the danger arises of short-circuiting established patterns. This danger is likely to be greatest (and the rationalization of short cuts easiest) where the board or administration lag behind the people in their awareness of social change or their ability to meet it. It follows, then, that the able administrator will take steps to establish and maintain procedures that are built on a philosophy of administration that recognizes the value of balance in two areas: the one, between authority and responsibility; the other, between professional expertness and public sanction.

FINANCE

The spurt in productivity which is virtually certain to result from the introduction of automation will have serious implications for education. These will fall into several categories and each will impinge upon schools in a different way.

The first industrial revolution set off a seemingly endless rise in productivity per man-hour of labor. Since that time vast and far-reaching changes have taken place in the way the fruits of this productive capacity are distributed. The real wages of workmen, both in industry and in the service occupations, have climbed to heights once unimagined, and the curve is still ascending. Meanwhile the division of the proceeds between capital and labor has been the subject of continuous bargaining and readjustment.

As a consequence of these events the worker enjoys a growing power to buy goods and services. Among his purchases, which he makes through private arrangements and public agencies, has been more and better schooling for his children. The difference in the purchasing power of the upper and lower socio-economic groups has narrowed, and many of the traditional cultural differences between these groups have tended to disappear. Social mobility has increased and wider access to education has become a major means for accelerating this fluidity in our society. It is to be expected that with further increases in wage levels, combined with the need for more and better-educated people, this movement will go forward at an even faster rate.

If this view of the future is correct, schools will face the demands

of parents that still more children receive extended education. This, in turn, will further increase and further diversify the school population. The cost of operating schools will be raised as a direct consequence.

Elevated wage rates in industry and in the private-enterprise service fields will create more severe competition for manpower, and government service, including schools, will be directly affected to a degree even greater than at present. Similarly, private educational institutions such as colleges will find their bargaining positions further reduced.

This effect will not be limited to comparative wages alone. The high-level types of personnel from which teachers must be drawn will always be in short supply. As the demand for such people in technical and managerial work rises, it is reasonable to assume that special inducements will be offered to them by private employers. If a laissez-faire policy is followed the easily predictable outcome will be schools staffed exclusively by two types of people—those too limited in capacity to be of interest to industry, and those so strongly drawn to education that they will sacrifice their own opportunities and the economic welfare of their dependents in order to remain in teaching. The former group are obviously undesirable as teachers, and there will be too few of the latter to staff more than a fraction of the classrooms. Even the second group will be likely after a time to reject teaching because the low salaries will imply a social status unattractive to self-respecting professionals.

Clearly, a new balance must be struck in the distribution of the fruits of our productivity. It may well develop that a major outcome of this new phase of our economic evolution will be the decision to assign a substantial part of the increased national product to neither capital nor labor as such, but to those social and cultural agencies, governmental and voluntary, which serve society in general. Unless such a decision is reached it is difficult to imagine how the economy will be able to continue to find the intellectual resources upon which it ultimately depends.

What is set forth here is but the broadest generalization. The implementation of such a policy will require a great number of changes at local, state, and national levels. It will involve also a re-examination of the relations between public and private activity.

Is it possible in America, for example, to find a means to tap our productivity to assure firm and adequate support for private colleges out of our income without subjecting them to governmental control? Is it possible to collect funds nationally and distribute them for the support of local public schools without decreasing the autonomy of local school boards? Are the national-level groups, governmental and voluntary, and the top-level professional associations willing to forego the opportunity for "suggesting" nationwide standards in connection with the distribution of funds? These questions are as broad as the nation, but the answers to them can be as narrow as unenlightened minds. Nevertheless, the future—not alone of industrial improvement but of our total individual and social development—will be critically affected by the perceptiveness with which we identify these challenges and the wisdom with which we respond to them.

It would be a mistake to suggest that the financial implications of this matter are restricted exclusively to questions of top governmental or industrial policy. Serious questions for individual families and their children are also very much in the picture. Despite the increases in the wages of workers many families are still unable to support their sons and daughters through their high school years. For them a technical or liberal education beyond high school is quite out of the question. Yet within this group are thousands of potential skilled craftsmen or professional workers, young people with the native equipment so urgently sought in industry, science, education, and government.

Their problem is essentially financial. Even when they are written off in studies which describe them as lacking motivation toward higher education, often the real truth is that they do not aspire to college because they sense the futility—for them—of such unrealistic ambition.

In addition to whatever is done to strengthen the financing of education in broad institutional terms, or as a part of such plans, the national welfare dictates that ways be devised promptly to end the waste of this priceless resource. We cannot afford much more delay in establishing a comprehensive program of financial aid to poor but able boys and girls who should be well educated. The evidence is abundant and convincing that such a program will

yield a higher return than any other investment of comparable size.

We conclude, then, as we began this consideration of automation and schools, with the emphasis on individual, personal fulfillment.

Two hypotheses for education follow from the observations that have been made.

One is that the effort to conserve human energy so that increasingly it may be turned to higher purposes is more than an economic undertaking. It must be accompanied by a plan of universal education designed to help as many people as possible develop their individual potential and employ it in productive and satisfying ways.

The second hypothesis is that the building of such educational programs will depend upon the insight, knowledge, and skill of educational leaders and their ability to clarify for the people they serve the connection between educational means and cultural ends.

All our experience with democracy and all our faith in people lead to the assumption that with such leadership, against the background of our traditions and under the impact of the current situation, the American people will give their sanction to the commitments that must now be made.

4

THE MEANING OF AUTOMATION FOR EDUCATIONAL ADMINISTRATION

AFTER CONSIDERATION of the papers presented by Bolz, Limberg, and Fischer, a panel of NCPEA members discussed the question, "What does automation mean for educational administration and for the professional preparation of administrators?" The comments of various members are summarized in the paragraphs that follow:

DANIEL R. DAVIES:[1] *Current Organization and Administration Patterns Are Obsolete.*

There are two phases of this problem I would like to discuss. One is this new leisure as it relates to education and to financing education. We know that it is going to take a lot more money than we are now spending to provide an adequate educational program. Where will the money come from?

We already have people with leisure in many communities. We have women with B.A.'s, M.A.'s, Ph.D.'s, and Phi Beta Kappa's. We have men who get home from work early, with not too much to do. Many of these people are knocking themselves out trying to be socially useful, and who gets the benefit? The psychiatrist, not the school. How can we use their talents for constructive ends?

Another thing I would like to know is whether there is any way of inventing a new pattern of instruction which will again take the family into account. We started with the family unit but got away from it by asking the schools to do all sorts of things, including character training. I think this is asking too much. I think the mother, the father, the grandfather, and the grandmother have the real job of education. It may be that by virtue of automation we can give parents some real responsibility for educating their own children. Meanwhile, current organization of schools and administration is obsolete.

The second aspect involves learning a new language of management. The central planning board of the Standard Oil Company recently hired a young

[1] Professor of Education and Coordinator of the Cooperative Center for Educational Administration, Teachers College, Columbia University.

chemist and assigned to him the task of translating the language which was coming from its operating companies. This language of management emerged from policy-making decisions which the operating companies were making as the result of research they were carrying on. We, as professors of educational administration, must learn a lot more about the language of decision making and operating research. Does this mean we must stop resisting statistics and other mathematical language of research? Does it also mean that there is a whole new generation of specialists coming up in the school management field such as are now appearing in other management fields?

ORIN B. GRAFF:[2] *New Program for Preparing School Administrators Is Needed.*

For five hundred years man has used scientific procedures in the study of matter and energy, things and materials. Scientific method developed as these procedures gained stability and became understood as a method of invention. Invention is no longer a chance or haphazard thing; by using the scientific method man can invent what he needs of material things. This capacity for invention has brought us to automation—to where these inventions have extended man's capacity to produce at increasingly higher and higher levels.

On the other hand, man has scientifically studied his own behavior for only the past fifty years. Scientific knowledge about human action is thus far behind our knowledge of the behavior of matter and energy. We are making a great effort to catch up. In recent years studies have poured in new knowledge, but it is incoherent and hard to use because basic assumptions and methods of procedure are not as commonly agreed upon among social scientists as they are among physical scientists.

Because our knowledge of human behavior is contradictory, we lack unity in education. This is a great problem to those who are preparing school administrators in an age when new knowledge is coming in from every field so rapidly that it can scarcely be assimilated. Likewise, it is a great problem in this age when more and more tasks are becoming creative in character—requiring education for designing, operating, and maintaining machines on the one hand, and education for services of a higher order to human beings on the other.

These questions arise: Do we have sufficient understanding of human behavior to develop educational programs that will meet the problems created by automation? Can we use what knowledge we have gained to prepare school administrators? Can we continue to tolerate programs dedicated to knowledge assimilation? Can we educate a majority of our people to become more creative than they now appear to be?

What will a program for preparing school administrators be like if it is to meet this challenge? I think its curriculum cannot be centered in knowledge

[2] Head of the Department of Educational Administration and Supervision, College of Education, University of Tennessee.

as such, nor can it be organized in departments. Perhaps it should be problem-centered for both student and professor, and aimed at the induction of the student into the profession. If so, it must provide opportunity for student and professor to work together on the problems of the profession of educational administration. The burden of this type of program should rest mainly on the student's shoulders. Guidance should emphasize self-understanding in relation to job.

Since the real problems of educational administration cannot be confined to a department, persons from many disciplines would be involved in the preparation program. The solution of problems in this kind of cooperative setting would insure not only technical proficiency in educational administration but also insight into all the important aspects of our culture that are so essential for depth and penetration into any specialty.

Finally, it should be noted that the kind of educational process described above cannot be automated. One teacher can, through automation, push facts at millions, but education centered in problem solving requires more professors and fewer students. However, automation can help "the more professors and fewer students" by providing automated fact education, material goods, and services that provide freedom for the creative job of instruction.

VAN MILLER:[3] *School Administrators Must Learn Art of Corporate Decision Making.*

Automation will probably bring an intensification and extension of some of the things we have always talked about—namely, leadership in curriculum change and in school organization, shifts in vocation, and increase in the amount of leisure time. There are other ideas which call, not for intensification and extension of things we have talked about in the past, but for an attempt to make a real transition into action in areas where we have only given lip service. I would like to illustrate with just one of the many ideas we might talk about.

We have facility centralization and we have the cost of automatic equipment which calls for incorporation. It seems to me the basic decisions about the lives of people will be made more and more by corporations, whether they are public or private.

Our own experience in corporate decision making has been inadequate. Owners or voters now say, "You do well for us or we will get new managers." As employees or as citizens we say, "We will strike, or we will oppose the decision through noncompliance." Our attitude has been, "What can we get out of the corporation?" rather than "How can we really belong to the corporation and participate in it?"

It seems to me that if we are not going to be "kept animals," the school administrator is going to have to concern himself with using the corporations

[3] Professor of Education, University of Illinois, Urbana.

which people have always had, and especially the public school corporation, as a means to give persons experience in corporate decision making.

MAURICE SEAY:[4] *We Must Embark on a New Era of Research.*

Yes, automation is the framework, the focus for these three days of discussion, but perhaps we should be reminded that automation is only a symbol for us in this conference. There are other forces affecting our lives today which also produce change. Let us examine their implications for educational administration.

Citizens tomorrow will need more of a continuing education. New facts must be brought to all our citizens more rapidly. Results of research must be put into practice faster. New skills of today will be found outdated. Tomorrow, the child may get less of the educational dollar, because more of it will be spent on continuing education for adults.

Automation gives us much, but it may be the vehicle of passing for some of the grand old practices of our culture. Is this good? Is it bad? Automation will bring a shorter work week and a shorter work day for the industrial worker. Will there also be a demand for a shorter work week and work day on the part of the teachers, on the part of administrators, and, indeed, on the part of the students? And this "supersonic moron" we heard about yesterday, will it be a moron tomorrow? It does not take much imagination to see that real intelligence may be put into it. Then what will this mean in change for our teaching processes, instructional materials, and school construction?

I do not know the answers, but I am extremely interested in the thinking that we and other Americans are doing with respect to the research needed. The research we ought to be doing is yet to be planned.

[4] Director, Division of Education, W. K. Kellogg Foundation, Battle Creek, Michigan.

5

THIS WE BELIEVE . . .

THE NATIONAL CONFERENCE of Professors of Educational Administration, after intensive study of automation and its implications for the future, expresses its current beliefs in a series of statements which present the general judgment of the members of the Conference. They are important primarily in indicating the direction of thinking regarding the impact automation will have on society and on our educational institutions.

We happen to be living during a period in which change is occurring with the greatest rapidity the world has ever known. Change characterizes every phase of life, although certain changes may be more dramatic than others. Technological advancement is probably the most discernible. For instance, in 1940 the average commercial airline carried approximately twenty passengers and flew at a ground speed of one hundred and eighty miles an hour. Fifteen years later the average commercial plane carried from sixty to eighty passengers and flew at three hundred miles an hour. Planes now on the drafting boards will carry one hundred and twenty-five passengers and will fly at a speed of five hundred miles an hour.

In the field of economics equally important changes have occurred. The national income in 1940 was $81,000,000,000; today it is more than $330,000,000,000 a year. The average family income in 1940 was approximately $2,000; today it is $5,500.

Prior to the 1930's, the only recourse for the poverty-stricken was to be taken in by friends, if any, or to go to the "poor house." Today a national system of social security guarantees for most workers a modest but independent income in old age, in disability, and in unemployment.

The point is that we are moving forward on all fronts—social, economic, technological, scientific, medical, conservation, and others. The National Conference of Professors of Educational Administration is particularly concerned with the advancements taking place in education. At the present time, it is particularly interested in the meanings of automation for education and for the school.

The Conference recognizes that:

1. The processes of automation will develop rapidly and continuously.
2. Automation will accelerate presently evolving social trends, and initiate others.
3. Automation will certainly bring about a vast change in man's habits, and will require a great change in the ways he spends his time.
4. Automation and its impact on man and his world requires that society reaffirm and emphasize its beliefs in human values.
5. The school's responsibility for the education of people is greatly increased at the same time that it is given additional opportunity to discharge those responsibilities effectively.

In the light of the foregoing ideas the following statement of beliefs is presented by the Conference.

Concerning Automation and People:

1. We believe that the chief limitations upon the extension of automation are not technical but human.
2. We believe that in an age symbolized by automation it is imperative that increasing emphasis be given to a restudy of how people achieve social, civic, and spiritual values.
3. We believe that automation will make it increasingly necessary that satisfaction be found in the job performed and in the many other activities that will occupy much of the individual's time.
4. We believe that in an age of automation it is important for the individual to resist deadening conformity to common patterns and to find satisfaction in individual expression as well as in group membership.
5. We believe that the progressive shortening of the formal work day, with the accompanying readjustment in time commitments, will result in a school-

family unit in which there will be a realignment of educational activities, with the family unit assuming increasing emphasis and responsibility.

6. We believe that there will be an increasing tendency for all members of the family to be engaged in educational activity both at home and elsewhere.
7. We believe that in an age of automation it is the responsibility of society to provide appropriate education for all persons.
8. We believe that the utilization of automation in the processing of data enhances the prospect of reducing cultural lag.
9. We believe that education in an age of automation should accept no material or social barriers and must be universal, not only throughout the nation, but throughout the world.

Concerning Automation and Educational Programs:

10. We believe that a lifelong participation in individual and cooperative educational activities will become the most significant pattern of living for people of all ages, capacities, and interests during the age of automation ahead.
11. We believe that the educational programs in an age of automation must be made increasingly sensitive to the educational needs of adults as well as children.
12. We believe that an age of automation demands that the programs of schools make it increasingly possible for people to satisfy their human yearnings and to cultivate reflective judgment, creativity, and wisdom.
13. We believe that an age of automation demands the opportunity for all citizens to participate in a liberal, realistic, and human program of education.
14. We believe that school programs must increasingly educate for intelligent consumption—not only of goods and services, but equally of science, research findings, and the arts.
15. We believe an age of automation makes it imperative that more and more of our capable young people be prepared for social as well as physical and mechanical engineering tasks.
16. We believe that if school programs are to keep pace in an age symbolized by automation, critical and continuous evaluation of "book learning" and current methodology is essential.
17. We believe that in an age of automation it is appropriate that teaching methodology involve students actively in decision making on all matters which affect their work in school.
18. We believe that automation serves mankind well to the extent that schools and other agencies of society are increasingly successful in helping people to assume a large measure of responsibility for their fellow man.

19. We believe that in an age of automation teaching should emphasize the emergence of leadership, self-discipline, and effective interactions in families.

Concerning Automation and School Administration:

20. We believe that in an age of automation an increasing portion of the administrator's time and energy should be expended in the analysis and understanding of the interdependent nature of production and problems of distribution of goods and services.
21. We believe that school administration must attract more young people of vision and ability if the schools are to fulfill their proper function in an age of automation.
22. We believe that preparation programs must increasingly involve prospective administrators, professors, and others in the solution of problems that are real and significant.
23. We believe that, as automation symbolizes the careful planning that is necessary in any complex enterprise, preparation programs for school administrators must increasingly and realistically involve the student in planning.
24. We believe that school administrators in an age of automation must be competent to conduct and utilize the research that is needed in the operation of schools.
25. We believe that increasing productivity both requires and makes possible a higher level of financial support for education.
26. We believe that school administrators must be prepared to utilize innovations in data processing, communication, and instructional aids, to the extent that they contribute to the accomplishment of the major purposes of education.
27. We believe that school administrators must be increasingly alert to evidences of need for change and that they must be willing and able to make proper changes in organization, facilities, and procedures as they are needed.
28. We believe that school administrators should increasingly, and with greater effectiveness, involve all appropriate human resources in the work of the schools.
29. We believe that in an age of automation the personality of the teacher increasingly becomes the crucial element in achieving the basic objective of education—the development of the total personality of learners.
30. We believe that the effects of automation on the lives of people are such that the school must assume a major portion of the responsibility for providing opportunities for leadership to emerge wherever it exists in the community.
31. We believe that in an age of automation increasing attention must be given to cooperative decision making.

32. We believe that school administrators must be able to bring about conditions under which all people who are affected, including the administrator himself, are involved in really important ways in making group decisions.
33. We believe that in an age of automation the involvement and cooperation of many community organizations and individuals in the education of learners of all ages require special preparation for administration of community education rather than for administration of education merely in schools.

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